CLAIMS

1. A device comprising an array of structures on a substrate, wherein:

said array of structures is formed from a first surface layer comprising a first material, and said substrate comprises a second material, said first surface layer being sufficiently thin that stress fields at the interface of said surface layer and said substrate caused formation of separated regions of said first material on said substrate wherein said first surface layer comprises separated regions forming at least two structures, said at least two structures being each about 2 atoms to about 10 atoms in height and being separated from each other by about 10 nm to about 50 nm, wherein the direction of alignment of said separated regions and/or the relative position of adjacent said separated regions has been influenced by directing at least one first particle beam onto said surface layer and at a respective acute angle thereto.

2. The device of claim 1, wherein said first surface layer is disposed on a crystal plane of said substrate.

3. The device of claim 1, wherein plural layers are disposed on said substrate, said first surface layer being one of said plural layers.

4. The device of claim 3, wherein each of said plural layers comprises said first material.

5. The device of claim 4, wherein each of said plural layers comprises structures which are substantially regular and substantially linear, or substantially linear rows of dot-like structures.

6. The device of claim 5, wherein said structures in at least two adjacent of said plural layers are disposed substantially at right angles to

each other, or aligned in rows substantially at right angles to each other or substantially at 120 degrees to each other.

7. The device of claim 6, wherein said structures in at least two adjacent of said plural layers are arranged directly on each other.

8. The device of claim 3, wherein at least one intermediate layer exists between said structures of at least two adjacent of said plural layers.

9. The device of claim 1, wherein gaps in said first surface layer between said at least two structures are filled by at least one adsorbed gaseous material and material that has been deposited into the gaps.

10. The device of claim 1, wherein at least said first surface layer has an area larger than a few square centimeters.

11. The device of claim 1, wherein at least said first surface layer comprises a third material deposited thereon from a source other than a source from which the first material is deposited.

12. The device of claim 1, wherein said first material comprises calcium.

13. The device of claim 1, wherein said second material comprises calcium fluoride.

14. The device of claim 12, wherein said second material comprises calcium fluoride, and wherein said substrate comprises at least one (111) crystal plane surface, and at least a portion of said first surface layer is on at least one of said at least one (111) crystal plane surface.

15. The device of claim 1, wherein said first material comprises a semiconductor or a metal or an insulator.

16. A data storage device, comprising the device of claim 1.

17. An optoelectronic device, comprising the device of claim 1.

18. An electronic device, comprising the device of claim 1.

19. An electromechanical device, comprising the device of claim 1.

20. A device comprising an array of structures on a substrate, wherein:

said array of structures is formed from a first surface layer comprising a first material, said substrate comprises a second material having at least one crystal plane surface, wherein at least a portion of said first surface layer is on at least one of said at least one crystal surface, said first surface layer being sufficiently thin that stress fields at the interface of said surface layer and said substrate caused formation of separated regions of said first material on said substrate wherein said first surface layer comprises separated regions forming at least two structures, said first material comprises at least one substance selected from the group consisting of a metal, and a semiconductor, wherein said at least two structures are aligned and regularly spaced.

21. The device of claim 20, wherein said second material comprises calcium fluoride.

22. The device of claim 20, wherein said at least two structures comprise nanowires each about 2 atoms in height, wherein said at least two structures are separated from each other by about 10 nm.

23. The device of claim 21, wherein said at least two structures are each about 2 atoms in height, wherein said at least two structures are separated from each other by about 10 nm.

24. The device of claim 23, wherein said substrate comprises at least one (111) crystal plane surface, and at least a portion of said first

surface layer is on at least one of said at least one (111) crystal plane surface.

25. A surface patterning apparatus, comprising:

a vacuum chamber;

at least one particle source disposed within said vacuum chamber; and

a rotatable support disposed within said vacuum chamber that has a large enough area to enable a substrate to be attached thereto,

wherein at least one of said at least one particle source is adapted to direct a respective particle beam at a respective acute angle to a surface of a substrate attached to said support, and said angle and the type and energy of particles from a particle beam that can be generated from said at least one particle source can form in a surface layer on a substrate mounted on said support separated regions forming at least two structures that are each about 2 atoms in height and being separated from each other by about 10 nm, wherein at least one of a direction of alignment of the separated regions and a relative position of adjacent separated regions is dependent on the angle of the first particle source, and wherein said surface layer is sufficiently thin that stress fields at the interface of said surface layer and said substrate cause formation of separated regions of said first material on said substrate wherein said surface layer comprises separated regions forming at least two structures.

26. The surface patterning apparatus of claim 25, wherein said at least one particle source comprises a first particle source and a second particle source, said second particle source disposed within said vacuum chamber such that particles in a particle beam from the second particle source impinge on a substrate mounted on said support.

27. The surface patterning apparatus of claim 26, wherein the particles from the second particle source are different from the particles from the first particle source.

28. The surface patterning apparatus of claim 26, wherein said second particle source is adapted to produce a particle beam directed at a different angle than a beam produced by said first particle source.

29. The surface patterning apparatus of claim 26, wherein said second particle source is adapted to produce a particle beam disposed approximately perpendicular to a surface of a substrate on said support.

30. The surface patterning apparatus of claim 25, wherein said first particle source is adapted to produce a particle beam disposed at an angle of approximately 10° with respect to a surface of a substrate upon which structures are desired to be formed.

31. The surface patterning apparatus of claim 25, wherein said first particle source provides argon ions.

32. The surface patterning apparatus of claim 31, wherein said first particle source provides argon ions having a kinetic energy of approximately 4,500 eV, and said vacuum chamber can have a pressure of about 4×10^{-8} mbar.

33. The surface patterning apparatus of claim 25, wherein said first particle source can deposit onto a substrate mounted to said support a material comprising at least one of calcium and a semiconductor.

34. The surface patterning apparatus of claim 25, wherein said first particle source deposits material on a substrate mounted to said support sufficient to form structures on said substrate that are generally parallel to or aligned with a projection of an axis of a particle beam from said first particle source.

35. A substantially regular array of structures on a substrate formed by a method comprising the steps of:

providing a surface layer of a first material on a substrate of a second material, wherein said surface layer is sufficiently thin that stress fields at the interface of said surface layer and said substrate cause formation of separated regions of said first material on said substrate; and directing at least one first particle beam onto said surface layer and at a respective acute angle thereto to influence the direction of alignment of said separated regions and/or the relative position of adjacent said separated regions.

36. The substantially regular array of structures formed by the method of claim 35, wherein said step of providing said surface layer comprises depositing said layer on said substrate.

37. The substantially regular array of structures formed by the method of claim 36, wherein said surface layer is deposited by means of at least one second particle beam or source of gas particles which attach to the surface upon which structures are to be formed.

38. The substantially regular array of structures formed by the method of claim 35, wherein the step of providing said surface layer comprises modifying the surface of said substrate by means of at least one particle beam.

39. A data storage device comprising a substantially regular array of structures on a substrate formed by the process recited in claim 35.

40. An optoelectronic device comprising a substantially regular array of structures on a substrate formed by the process recited in claim 35.

41. An electronic device comprising a substantially regular array of structures on a substrate formed by the process recited in claim 35.

42. An electromechanical device comprising a substantially regular array of structures on a substrate formed by the process recited in claim 35.